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(54) **Color cathode ray tube apparatus**

Farbkathodenstrahlröhre

Tube à rayons cathodique couleur

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- **PATENT ABSTRACTS OF JAPAN vol. 015, no. 442 (E-1131), 11 November 1991 & JP-A-03 187132 (HITACHI LTD), 15 August 1991,**
- **PATENT ABSTRACTS OF JAPAN vol. 016, no. 318 (E-1232), 13 July 1992 & JP-A-04 092337 (SUMITOMO METAL MINING CO LTD), 25 March 1992,**
- **PATENT ABSTRACTS OF JAPAN vol. 014, no. 493 (E-0995), 26 October 1990 & JP-A-02 204943 (MITSUBISHI ELECTRIC CORP), 14 August 1990,**
- **PATENT ABSTRACTS OF JAPAN vol. 004, no. 133 (E-026), 18 September 1980 & JP-A-55 086049 (TOSHIBA CORP), 28 June 1980,**

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is magnified. Thus, the tension applied to the shadow mask will be larger that that in the normal actuation of the color cathode ray tube apparatus or the ordinary temperature. As a result, a plastic deformation occurs in the shadow mask. The tension applied to the shadow mask in which the plastic deformation occurs will be reduced at the ordinary temperature, and a mislanding will occur during operation of the color cathode ray tube apparatus.

[0009] An objective of this invention is to provide an improved color cathode ray tube apparatus, in which the tension applied to the shadow mask is uniform in each direction after the welding of the shadow mask on the frame. Another objective of this invention is to provide an improved cathode ray tube apparatus, in which no corrugation occurs on the shadow mask even when the shadow mask is welded on the frame with a predetermined tension, and the weight of the frame is not increased and the working process of the frame does not become complex. These objects are solved with the features of the claims.

[0010] For achieving the above-mentioned objectives, color cathode ray tube apparatuses of this invention commonly comprise a funnel, a panel, a phosphor screen disposed inside of the panel, a shadow mask disposed in the vicinity of the phosphor screen, a frame on which the shadow mask is fixed and an electron gun disposed in a neck part of the funnel. The frame has a shadow mask welding face which has a substantially rectangular shape, side walls which are continuously formed along an inner periphery of the shadow mask welding face and are substantially perpendicular to the shadow mask welding face and a flange face which is formed along the side walls and is substantially parallel to the shadow mask welding face. The shadow mask is fixed on the shadow mask welding face of the frame by welding under a condition that a predetermined tension is applied to the shadow mask. The mechanical strength of the longer sides of the frame is higher than that of the shorter sides of the frame. By such a configuration, quantities of the deformation along the longer sides and the shorter sides of the frame can be made equal to the quantities of the deformation of the shadow mask along the longer sides and the shorter sides. Thus, after the welding of the shadow mask on the frame, the tension applied to the shadow mask can be made even. Furthermore, the deformation of the frame is smaller, so that the tension applied to the shadow mask can be maintained in a predetermined value. Still furthermore, in a manufacturing process or normal actuation of the color cathode ray tube apparatus, even when the shadow mask and/or the frame are/is deformed by thermal expansion, an assembly in which the shadow mask is welded on the frame maintains a similar shape to that of the initial state. Thus, no corrugation occurs on the shadow mask face. As a result, the thermal expansion of the shadow mask can be cancelled or absorbed by the tension applied to the shadow mask. Positions of electron beam through holes and phosphor regions on a phosphor screen of the color cathode ray tube apparatus are then relatively coincident with each other. The mislanding in a picture image displayed on the screen of the color cathode ray tube apparatus can be reduced.

[0011] By such a configuration according to the invention, the frame, in which the mechanical strength of the longer side is higher than that of the shorter side, can easily be obtained by applying the conventional frame.

[0012] Still furthermore, it is preferable that a width of at least a part of the flange face on each longer side of the frame is wider than a width of the flange face on each shorter side of the frame. Alternatively, it is preferable that the side wall on each longer side of the frame swells outward on a plane parallel to the shadow mask welding face. Alternatively, it is preferable that at least a part of the flange face on each shorter side of the frame is cut out. Alternatively, it is preferable that the flange face of each shorter side is warped in a manner so that a height of the lowest part of the shorter side of the frame is lower than the height of the longer side. By such a configuration, the frame, in which the mechanical strength of the longer side is higher than that of the shorter side, likewise can easily be obtained. In these cases, the frame can be formed integrally by press working, so that the configurations of the frame are suitable for mass production.

[0013] Furthermore, it is preferable that the longer sides and the shorter sides of the frame are respectively formed as independent members, and a thickness of a first member for the longer side is larger than that of a second member for the shorter side. Alternatively, it is preferable that the longer sides and the shorter sides of the frame are respectively formed as independent members, and a material of a first member for the longer side is different from that of a second member for the shorter side. By such a configuration, the frame, in which the mechanical strength of the longer side is higher than that of the shorter side, can be obtained. These configurations of the frame are suitable for a production of small quantity. In the latter case, it is especially preferable that Young's modulus of the material of the first member for the longer side is higher than that of the second member for the shorter side. Thereby, the thickness and the shape of the cross-section of the first member can be made the same as those of the second member. As a result, the assembly of the frame can be made easier without using any special jig.

[0014] Furthermore, it is preferable that a thermal expansion coefficient of a material of the frame is smaller than that of a material of the shadow mask. By such a configuration, it is possible to prevent the plastic deformation of the shadow mask due to the difference between the heat capacities of the frame and the shadow mask, when the funnel and the panel of the color cathode ray tube apparatus, which are made of glass, are connected.

[0015] In a further embodiment of a color cathode ray

configuration of an embodiment of a color cathode ray tube apparatus of this invention;

FIG.12 is a perspective view showing a configuration of a frame in the embodiment of figure 11;

FIG.13 is a perspective view showing a configuration of a frame in an embodiment of a color cathode ray tube apparatus of this invention;

FIGs. 14(a), 14(b) and 14(c) are respectively cross-sectional side views showing configurations of the frame along A-A, B-B and C-C lines;

FIG.15 is a perspective view showing a configuration of a frame in an embodiment of a color cathode ray tube apparatus not forming part of this invention;

FIG.16 is a drawing showing the temperature rise of a shadow mask during normal operation of the color cathode ray tube apparatus;

FIG.17 is a drawing showing a characteristic curve of the reduction of a tension applied to the shadow mask; and

FIG.18 is a drawing showing characteristic curves of the thermal expansion of the shadow mask and the frame.

[0021] A first embodiment of a color cathode ray tube apparatus of this invention is described referring to FIGs. 1 to 4. As can be seen from FIG.1, the first embodiment of the color cathode ray tube apparatus of this invention comprises a funnel 1 made of glass, a panel 2 made of glass, a phosphor screen 8 disposed inside of the panel 2, a shadow mask 3 disposed in the vicinity of the phosphor screen 8, a frame 4 for supporting the shadow mask 3, and an electron gun 6 disposed in a neck part of the funnel 1. The shadow mask 3 is fixed on the frame 4 by resistance welding, laser welding working, and the like under a condition that a predetermined tension of about 10 Kg/mm^2 is applied to the shadow mask 3. The longer sides of the frame are about 333 mm, and the shorter sides are about 256 mm. The cross-sectional shapes of the respective sides are substantially L-shaped.

[0022] Electron beams, which correspond to red, green and blue colors and are radiated from the electron gun 6, pass through predetermined electron beam through holes formed on the shadow mask and reach predetermined phosphor regions of the phosphor screen 8 corresponding to the colors of the electron beams. Each phosphor region, which is irradiated by the electron beam, luminates the color of red, green or blue corresponding to the electron beam. Thus, a color picture image can be displayed on the screen of the panel 2 of the color cathode ray tube apparatus.

[0023] As can be seen from FIG.2, the frame 4 has a substantially rectangular shape viewed on a plane parallel to the shadow mask 3. A shadow mask welding face 41, which is parallel to the shadow mask 3, is formed at an open end of the frame 4. Flange faces 43a and 43b, which are parallel to the shadow mask welding face 41, are formed at the other open end of the frame 4. Side walls 42a and 42b are integrally formed along the inner peripheries of longer sides 41a and shorter sides 41b of the shadow mask welding face 41. Furthermore, the side walls 42a and 42b and the flange faces 43a and 43b are respectively formed integrally. Reinforcing plates 44 are respectively fixed on the flange faces 43a on the longer sides.

[0024] The frame 4 shown in FIG.2 can be obtained by fixing the reinforcing plates 44 by spot welding and the like on a frame which is conventionally used and is integrally formed by press working. As mentioned above, when the reinforcing plates 44 are provided on the flange faces 43a on the longer sides of the frame 4, a frame, in which the mechanical strength of the longer sides is higher than that of the shorter sides, can easily be obtained. Alternatively, as shown in FIG.3, substantially rectangular plates 45, which are obliquely fixed between the side walls 42a and the flange faces 43a on the longer sides, can be used as reinforcing plates. Thereby, the mechanical strength of the longer sides can be made higher than that of the shorter sides. Alternatively, as shown in FIG.4, substantially triangle plates 46, which are fixed between the side walls 42a and the flanges 43a on the longer sides at a predetermined intervals and oriented to be perpendicular to the shadow mask 3, can be used as reinforcing plates. Thereby, the mechanical strength of the longer sides similarly can be made higher than that of the shorter sides.

[0025] For discussion, the length of the longer sides (41a, 42a, 43a) of the frame 4 will be called L1, the length of the shorter sides (41b, 42b, 43b) of the frame 4 L2, Young's modulus of the shadow mask 3 along the longer side E1, Young's modulus of the shadow mask 3 along the shorter sides E2, a tension applied to the shadow mask 3 in a direction parallel to the longer sides T1, a tension applied to the shadow mask 3 in a direction parallel to the shorter sides T2, a rigidity of the longer sides of the frame 4 G1. and a rigidity of the shorter sides of the frame 4 G2. When the material and the shape of the frame 4 satisfy the equation of

$$\frac{L2 \cdot E1 \cdot T1}{L1 \cdot E2 \cdot T2} = \frac{G1}{G2},$$

quantities of the deformation of the longer sides and the shorter sides of the frame 4 can be made the same as those of the shadow mask 3. Thus, even when the shadow mask 3 is welded on the frame 4, the tension applied to the shadow mask 3 can be made even in each direction. As a result, the position of each electron beam through hole formed on the shadow mask 3 and the position of the phosphor region corresponding to the electron beam through hole can coincide with each other. Mislanding of the picture image on the screen can be prevented substantially perfectly.

[0026] As a material of the shadow mask 3, iron was used. As a material of the frame 4, an alloy selected from

and the shorter sides of the frame 4 are respectively formed as independent members 4a and 4b. The thickness of the longer side member 4a is larger than that of the shorter side member 4b. Since the material of the longer side member 4a is essentially the same as that of the shorter side member 4b, the frame 4 can be assembled by welding. By such a configuration, a frame in which the mechanical strength of the longer side is higher than that of the shorter sides can be obtained. Alternatively, it is possible that the material of the longer side member 4a is different from that of the shorter side member 4b. In this case, a material having Young's modulus larger than that of the material of the shorter side member 4b can be used as the material of the longer side member 4a. Thereby, the thickness and the cross-sectional shape of the longer side member 4a can be made the same as those of the shorter side member 4b. In the former case shown in FIG.9, a special jig for adjusting the difference between the thickness of the longer side member 4a and the thickness of the shorter side member 4b is necessary. However, in the latter case shown in FIG.10, since the thickness of the longer side member 4a can be made the same as that of the shorter side member 4b, the special jig for adjusting the difference between the thicknesses is not necessary. Thereby, the difficulty of the welding due to the difference of the materials of the longer side member 4a and the shorter side member 4b in the latter case can be reduced. As the combination of the materials of the longer side member 4a and the shorter side member 4b, an alloy including aluminum and stainless steel or normal steel, and stainless steels having different components can be used. This embodiment is suitable for a production of small quantity.

[0035] Next, an embodiment of a color cathode ray tube apparatus of this invention is described referring to FIGs. 11 and 12. As can be seen from FIG.11, the configuration of this embodiment of the color cathode ray tube apparatus is substantially the same as that of the first embodiment shown in FIG.1 except the shape of the frame 4. Thus, the detailed explanation of the configuration of this embodiment of the color cathode ray tube apparatus is omitted.

[0036] As can be seen from FIG.12, the frame 4 has a substantially rectangular in cross-section viewed on a plane parallel to the shadow mask 3 (not shown in FIG. 12). A shadow mask welding face 41, which is parallel to the shadow mask 3 and on which the shadow mask 3 is to be welded, is formed at an open end of the frame 4. A flange face 43, which is parallel to the shadow mask 3, is formed at the other open end of the frame 4. The shadow mask welding face 41 is a substantially rectangular shape, in which respective longer sides 41a and shorter sides 41b are integrally formed. No cutting is formed at each corner. Side walls 42 are integrally formed along inner peripheries of the sides 41a and 41b of the shadow mask welding face 41. Perpendicular portions 142a which are perpendicular to the shadow mask welding face 41 and slanted portions 142b which are slanted inside of the frame 4 are alternately formed on the side walls 42. Furthermore, the side walls 42 and the flange face 43 are integrally formed.

[0037] Namely, the frame shown in FIG.12 is formed integrally by press working. For making the press working easy, the ridge lines at the top of the slanted portions 142b on the side walls 42 are substantially parallel to the sides 41a or 41b of the shadow mask welding face 41. On a plane perpendicular to the shadow mask 3, a substantially triangular opening 142d is formed by the perpendicular portion 142a and the slanted portion 142b of the side walls 42 and the flange face 43. Furthermore, the cross-sectional shape of the side walls 42 on a plane parallel to and in the vicinity of the shadow mask welding face 41 is substantially octagonal. By such a configuration, a gap 41d can be formed between each corner 41c of the shadow mask welding face 41 and the side walls 42. Thus, the shape of each corner 41c of the shadow mask welding face 41 can be stable in the press working, and the flatness of the shadow mask welding face 41 can be maintained.

[0038] Responding to the length of the longer sides 41a and the shorter sides 41b and the tension applied to the shadow mask 3, at least one of dimension and number of the perpendicular portions 142a and the slanted portions 142b is varied. In this embodiment, the width of the perpendicular portions 142a and the number of the slanted portions 142b are varied.

[0039] By the above-mentioned configuration, the slanted portions 142b which are formed on the side walls 42 and slanted to the inside of the frame 4 serve as ribs. Thus, the rigidity of the frame 4 against the tension applied to the shadow mask 3 can be made higher, without increasing the weight of the frame 4. The deformation of the frame 4 due to the tension applied to the shadow mask 3 can be prevented. Furthermore, the longer side 41a and the shorter side 41b are continuously formed at each corner of the shadow mask welding face 41, and no cutting is formed at the corner of the shadow mask welding face 41. The tension applied to the shadow mask 3 may not be uneven in the vicinity of the corners of the shadow mask welding face 41, so that no corrugation occurs in the vicinity of the corners.

[0040] Next, an embodiment of a color cathode ray tube apparatus of this invention is described referring to FIGs. 13, 14(a), 14(b) and 14(c). The configuration of this embodiment of the color cathode ray tube apparatus is substantially the same as the configuration of the embodiments shown in FIG. 1 or 11, except for the shape of the frame 4. Thus, the duplicating description of the configuration of this embodiment of the color cathode ray tube apparatus is omitted.

[0041] As can be seen from FIG.13, the frame 4 in this embodiment is substantially rectangular in cross-section viewed on a plane parallel to the shadow mask 3 (not shown in FIG.13). A shadow mask welding face 41, which is parallel to the shadow mask 3 and on which the

shadow mask 3 due to the heat treatment. However, it is necessary that the tension applied to the shadow mask 3 in the assembly of the shadow mask assembly is 9.4 kg/mm^2. Thus, it is impossible to make the tension applied to the shadow mask 3 zero.

[0051] Therefore, a shadow mask assembly, in which the tension applied to the shadow mask 3 is zero at the temperature of 450 degrees Celsius in the heat treatment and the tension cancelling the thermal expansion can be applied to the shadow mask 3 during the normal operation of the color cathode ray tube apparatus, is necessary. For obtaining such a shadow mask assembly, a thermal expansion coefficient α_F of the frame 4, in which the characteristic curve A of the thermal expansion of the shadow mask 3 and the characteristic curve B of the frame 4 cross at 450 degrees Celsius, is obtained from FIG.18. A relation between the thermal expansion coefficient α_F of the frame 4, by which the tension applied to the shadow mask 3 becomes zero at 450 degrees Celsius, and the thermal expansion coefficient α_M of the shadow mask 3 is shown by the equation of

$$\alpha_F \leqq \alpha_M (1-(\Delta t_o/\Delta t)).$$

Herein, the temperature rise of the shadow mask 3 during the normal operation of the color cathode ray tube apparatus is Δ to (°C) and the temperature rise of the shadow mask 3 in the heat treatment during the producing process of the color cathode ray tube apparatus is Δt (°C). The thermal expansion coefficient can be decided by the above-mentioned equation.

[0052] When the shadow mask 3 is made of iron, the thermal expansion coefficient of the frame α_F is obtained by

$$\alpha_F \leqq 12 \times 10^{-6} \times (1-(80/430)).$$

Namely, the value of the thermal expansion coefficient of the frame 4 is to be smaller than 9.7×10^{-6} (1/°C). A material having a thermal expansion coefficient similar to the above-mentioned value is 50%Ni-Fe alloy. By such a configuration, the plastic deformation of the shadow mask in the heat treatment can be prevented. Thus, the reduction of the tension applied to the shadow mask 3 due to the plastic deformation of the shadow mask 3 can be prevented.

Claims

1. A color cathode ray tube apparatus comprising a funnel (1), a panel (2), a phosphor screen (8) disposed inside of said panel (2), a shadow mask (3) disposed in the vicinity of said phosphor screen (8), a frame (4) on which said shadow mask (3) is fixed and an electron gun (6) disposed in a neck part of said funnel (1); said frame (4) having a shadow mask welding face (41) which has a substantially rectangular shape defined by opposed pairs of longer and shorter sides, side walls (42a, 42b) which are continuously formed along an inner periphery of said shadow mask welding face (41) and are substantially perpendicular to said shadow mask welding face (41), and a flange face (43a,43b) which is formed along said side walls (42a,42b) and is substantially parallel to said shadow mask welding face (41), characterized by that

said shadow mask (3) is fixed on said shadow mask welding face (41) of said frame (4) by welding under a condition that a predetermined tension is applied to said shadow mask (3); and

at least one reinforcing member (44;45;46) is provided on said flange face (43a) each of the longer sides (43a) of said frame (4) so that a mechanical strength of the longer sides (42a, 43a) of said frame (4) is higher than that of the shorter sides (42b,43b) of said frame.

2. The apparatus in accordance with claim 1, wherein said reinforcing member (45) has a rectangular shape and is obliquely mounted between said side wall (42a) and said flange face (43a) of said frame (4).

3. The apparatus in accordance with claim 1 or 2, wherein another reinforcing member is further provided on each of the longer and shorter sides of said frame, but at least one of shape, thickness, and material of said reinforcing members provided on the longer sides is different from that of said reinforcing members provided on the shorter sides.

4. The apparatus according to claim 1, wherein said reinforcing member (46) has a substantially triangle shape and is mounted is between said side wall (42a) and said flange face (43a) and oriented substantially perpendicular to said shadow mask welding face (41).

5. The apparatus in accordance with claim 4, wherein at least one other reinforcing member (44;45;46) is further provided on each of the longer sides and shorter sides of said frame, but at least one of shape, thickness, number and material of said reinforcing members provided on the longer sides is different from that of said reinforcing members provided on the shorter sides.

6. The apparatus in accordance with any one of claims 1 to 5 wherein a width (W1) of at least a part of said flange face (43a) on each longer side of said frame (4) is wider than a width (W2) of said flange face (43b) on each shorter side of said frame (4).

in ridge lines (145a) of said side walls (145) and said shadow mask welding face (41) are straight lines, and ridge lines (145b) of said side walls (145) and said flange face (43) are substantially alternating sign wave forms.

22. The apparatus in accordance with claim 20 or 21, wherein a cross-sectional shape of said side walls (145) of said frame (4) in the vicinity of a boundary between said shadow mask welding face (41) and said side walls (145) on a plane parallel to said shadow mask welding face (41) is substantially octagonal.

23. The apparatus in accordance with claim 20, 21, or 22 wherein said frame (4) is integrally formed by press working.

24. The apparatus in accordance with any one of claims 15 to 23 wherein a thermal expansion coefficient of a material of said frame (4) is smaller than that of a material of said shadow mask (3).

Patentansprüche

1. Farbkathodenstrahlröhrenvorrichtung mit einem Trichter (1), einer Platte (2), einem innerhalb der Platte (2) angeordneten Phosphorschirm (8), einer in der Nähe des Phosphorschirms (8) angeordneten Schattenmaske (3), einem Rahmen (4), auf welchem die Schattenmaske (3) befestigt ist, und einer in einem Halsteil des Trichters (1) angeordneten Elektronenkanone (6); wobei der Rahmen (4) eine Schattenmasken-Anschweißfläche (41), welche eine im wesentlichen rechteckige Form gebildet durch gegenüberliegende Paare längerer und kürzerer Seiten besitzt, Seitenwände (42a , 42b), welche zusammenhängend entlang einem Innenumfang der Schattenmasken-Anschweißfläche (41) ausgebildet und im wesentlichen senkrecht zu der Schattenmasken-Anschweißfläche (41) angeordnet sind, und eine Flanschfläche (43a, 43b), welche entlang den Seitenwänden (42a, 42b) ausgebildet ist, und im wesentlichen parallel zu der Schattenmasken-Anschweißfläche (41) verläuft, aufweist, dadurch gekennzeichnet, daß

die Schattenmaske (3) auf der Schattenmasken-Anschweißfläche (41) durch Schweißen in einem Zustand befestigt ist, daß eine vorbestimmte Spannung auf die Schattenmaske (3) ausgeübt wird; und
wenigstens ein Verstärkungselement (44; 45; 46) an der Flanschfläche (43a) jeder längeren Seite (43a) des Rahmens (4) vorgesehen ist, so daß eine mechanische Festigkeit der längeren Seiten (42a, 43a) des Rahmens (4) höher als die der kürzeren Seiten (42b, 43b) des Rahmens ist.

2. Vorrichtung nach Anspruch 1, wobei das Verstärkungselement (45) eine rechteckige Form aufweist und schräg zwischen der Seitenwand (42a) und der Flanschfläche (43a) des Rahmens (4) befestigt ist.

3. Vorrichtung nach Anspruch 1 oder 2, wobei ein weiteres Verstärkungselement ferner an jeder längeren und kürzeren Seite des Rahmens vorgesehen ist, aber wenigsten eines von Form, Dicke und Material der an den längeren Seiten vorgesehenen Verstärkungselemente sich von dem der an den kürzeren Seiten vorgesehenen Verstärkungselemente unterscheidet.

4. Vorrichtung nach Anspruch 1, wobei das Verstärkungselement (46) eine im wesentlichen dreieckige Form aufweist und zwischen der Seitenwand (42a) und der Flanschfläche (43a) befestigt und im wesentlichen senkrecht zu der Schattenmasken-Anschweißfläche (41) angeordnet ist.

5. Vorrichtung nach Anspruch 4, wobei wenigstens ein weiteres Verstärkungselement (44; 45; 46) ferner an jeder längeren und kürzeren Seite des Rahmens vorgesehen ist, aber wenigsten eines von Form, Dicke und Material der an den längeren Seiten vorgesehenen Verstärkungselemente sich von dem der an den kürzeren Seiten vorgesehenen kürzeren Seiten unterscheidet.

6. Vorrichtung nach einem der Ansprüche 1 bis 5, wobei eine Breite (Wl) wenigstens eines Teils der Flanschfläche (43a) an jeder längeren Seite des Rahmens (4) breiter als eine Breite (W2) der Flanschfläche (43b) an jeder kürzeren Seite des Rahmens (4) ist.

7. Vorrichtung nach einem der Ansprüche 1 bis 6, wobei sich die Seitenwand (42a) an jeder längeren Seite des Rahmens (4) nach außen wölbt.

8. Vorrichtung nach einem der Ansprüche 1 bis 7, wobei wenigstens ein Teil der Flanschfläche (43b) an jeder kürzeren Seite des Rahmens (4) ausgeschnitten ist.

9. Vorrichtung nach einem der Ansprüche 1 bis 8, wobei die Flanschfläche (43b) an jeder kürzeren Seite des Rahmens (4) in einer Weise gewölbt ist, so daß eine Höhe (H2) an dem niedrigsten Teil der Seitenwand (42b) an jeder kürzeren Seite des Rahmens (4) niedriger als eines Höhe (H1) der Seitenwand (42a) an jeder längeren Seite ist.

10. Vorrichtung nach einem der Ansprüche 1 bis 9, wo-

23. Vorrichtung nach Anspruch 20, 21 oder 22, wobei der Rahmen (4) in einem Stück durch Preßformung erzeugt ist.

24. Vorrichtung nach einem der Ansprüche 15 bis 23, wobei ein Wärmeausdehnungskoeffizient eines Materials des Rahmens (4) kleiner als der eines Materials der Schattenmaske (3) ist.

Revendications

1. Dispositif à tube à rayons cathodiques couleur comprenant une partie conique (1), un panneau (2), un écran fluorescent (8) disposé à l'intérieur dudit panneau (2), un masque perforé (3) disposé au voisinage dudit écran fluorescent (8), un cadre (4) sur lequel ledit masque perforé (3) est fixé et un canon à électrons (6) disposé dans une partie étroite de ladite partie conique (1) ;

   ledit cadre (4) comportant une face de soudure du masque perforé (41) qui présente une forme sensiblement rectangulaire définie par des paires opposées de côtés plus longs et de côtés plus courts, des parois latérales (42a, 42b) qui sont continuellement formées le long d'une périphérie interne de la face de soudure du masque perforé (41) et sont sensiblement perpendiculaires à ladite face de soudure du masque perforé (41) et une face de rebord (43a, 43b) qui est formée le long desdites parois latérales (42a, 42b) et est sensiblement parallèle à ladite face de soudure du masque perforé (41), caractérisé en ce que
   ledit masque perforé (3) est fixé sur ladite face de soudure du masque perforé (41) dudit cadre (4) par soudure à condition qu'une tension prédéterminée soit appliquée audit masque perforé (3) ; et au moins un élément de renforcement (44 ; 45 ; 46) est prévu sur ladite face de rebord (43a) de chacun des côtés les plus longs (43a) dudit cadre (4) de sorte qu'une résistance mécanique des cotés les plus longs (42a, 43a) dudit cadre (4) est plus grande que celle des côtés les plus courts (42b, 43b) dudit cadre.

2. Dispositif selon la revendication 1, dans lequel ledit élément de renforcement (45) présente une forme rectangulaire et est monté à l'oblique entre ladite paroi latérale (42a) et ladite face de rebord (43a) dudit cadre (4).

3. Dispositif selon la revendication 1 ou 2, dans lequel un autre élément de renforcement est de plus prévu sur chacun des côtés les plus longs et des côtés les plus courts dudit cadre, mais au moins un élément de la forme, de l'épaisseur du matériau, desdits éléments de renforcement prévus sur les côtés les plus longs est différent de celui desdits éléments de renforcement prévus sur les côtés les plus courts.

4. Dispositif selon la revendication 1, dans lequel ledit élément de renforcement (46) présente une forme sensiblement triangulaire et est monté entre ladite paroi latérale (42a) et ladite face de rebord (43a) et est orienté sensiblement perpendiculaire à ladite face de soudure du masque perforé (41).

5. Dispositif selon la revendication 4, dans lequel au moins un autre élément de renforcement (44 ; 45 ; 46) est de plus prévu sur chacun des côtés les plus longs et des côtés les plus courts dudit cadre, mais au moins un élément de la forme, de l'épaisseur, du nombre et du matériau desdits éléments de renforcement prévus sur les côtés les plus longs est différent de celui desdits éléments de renforcement prévus sur les côtés les plus courts.

6. Dispositif selon l'une quelconque des revendications 1 à 5, dans lequel une largeur (W1) d'au moins une partie de ladite face de rebord (43a) sur chaque côté le plus long dudit cadre (4) est plus large qu'une largeur (W2) de ladite face de rebord (43b) sur chaque côté le plus court dudit cadre (4).

7. Dispositif selon l'une quelconque des revendications 1 à 6, dans lequel ladite paroi latérale 42a sur chaque côté le plus long dudit cadre (4) se bombe vers l'extérieur.

8. Dispositif selon l'une quelconque des revendications 1 à 7, dans lequel au moins une partie de ladite face de rebord (43b) sur chaque côté le plus court dudit cadre (4) est découpé.

9. Dispositif selon l'une quelconque des revendications 1 à 8, dans lequel

   ladite face de rebord (43b) sur chaque côté le plus court dudit cadre (4) est recourbée de manière à ce que
   une hauteur (H2) à la partie la plus basse de la paroi latérale (42b) sur chaque côté le plus court dudit cadre (4) est plus basse qu'une hauteur de la paroi latérale (42b) sur chaque côté le plus long.

10. Dispositif selon l'une quelconque des revendications 1 à 9, dans lequel lesdits côtés les plus longs (42a, 43a) et lesdits côtés les plus courts (43a, 43b) dudit cadre (4) sont respectivement formés à partir de premier et second éléments indépendants (4a, 4b) et une épaisseur du premier élément (4a) pour ledit côté le plus long est plus grande que celle du second élément (4b) pour ledit côté le plus court.

23. Dispositif selon la revendication 20, 21 ou 22, dans lequel ledit cadre (4) est solidairement formé par travail à la presse.

24. Dispositif selon l'une quelconque des revendications 15 à 23, dans lequel un coefficient de dilatation thermique d'un matériau dudit cadre 4 est plus petit que celui d'un matériau dudit masque perforé (3).

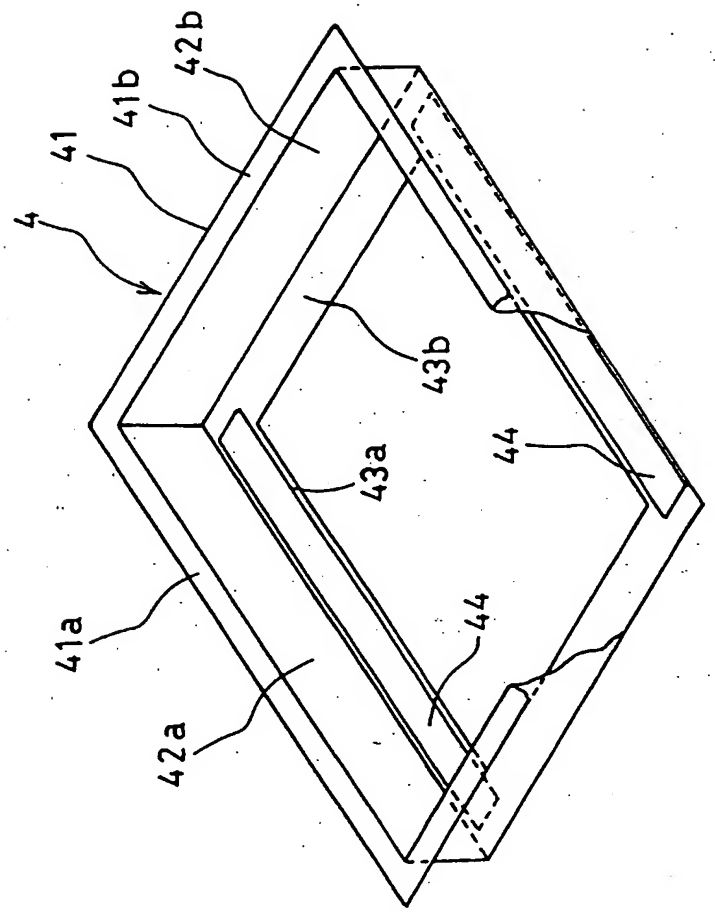

FIG. 2

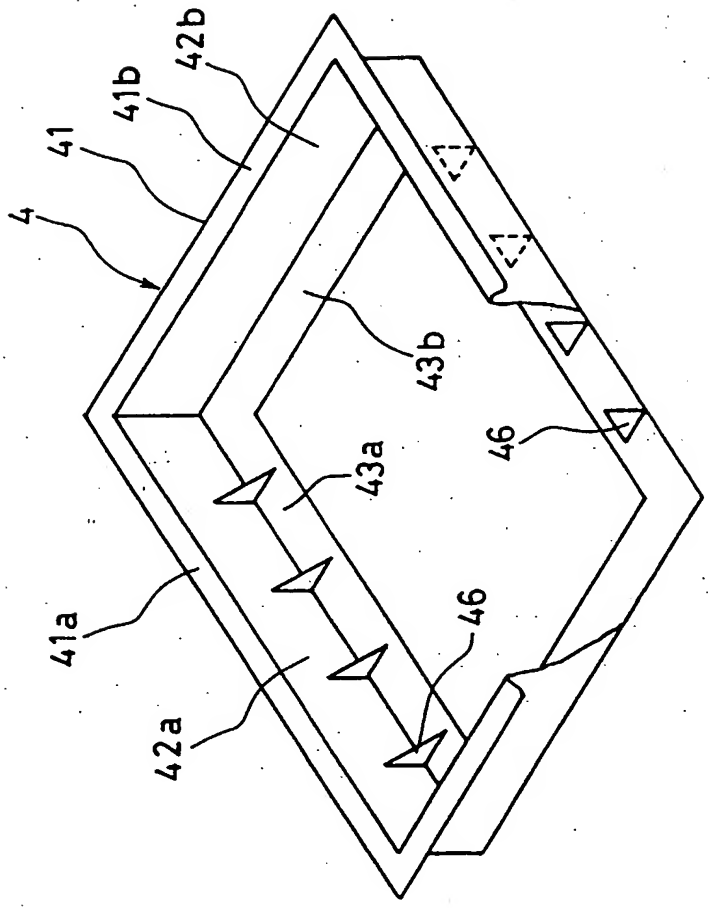

FIG.4

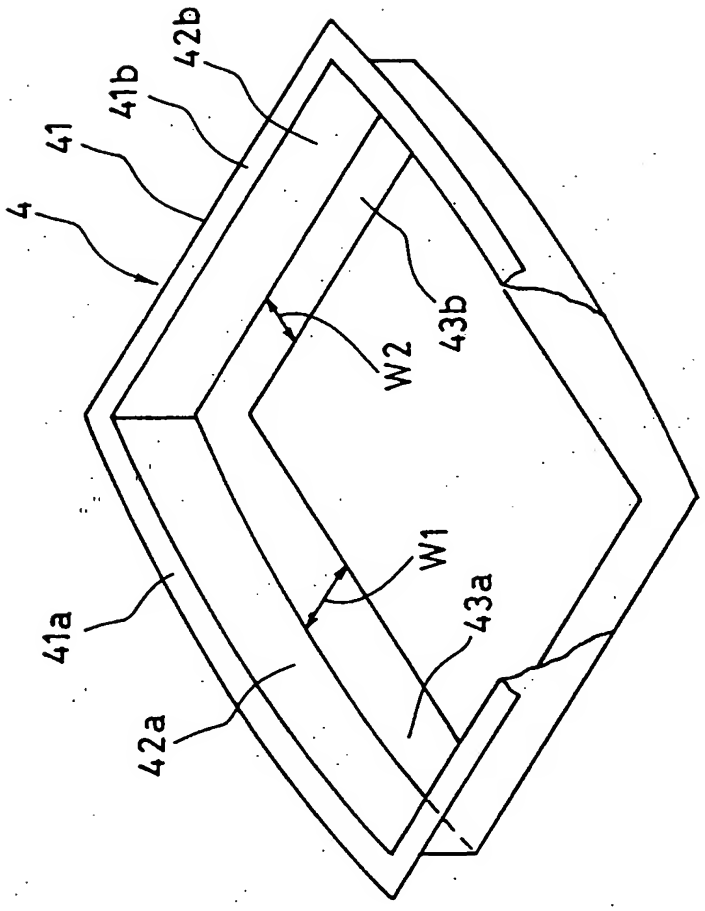

FIG. 6

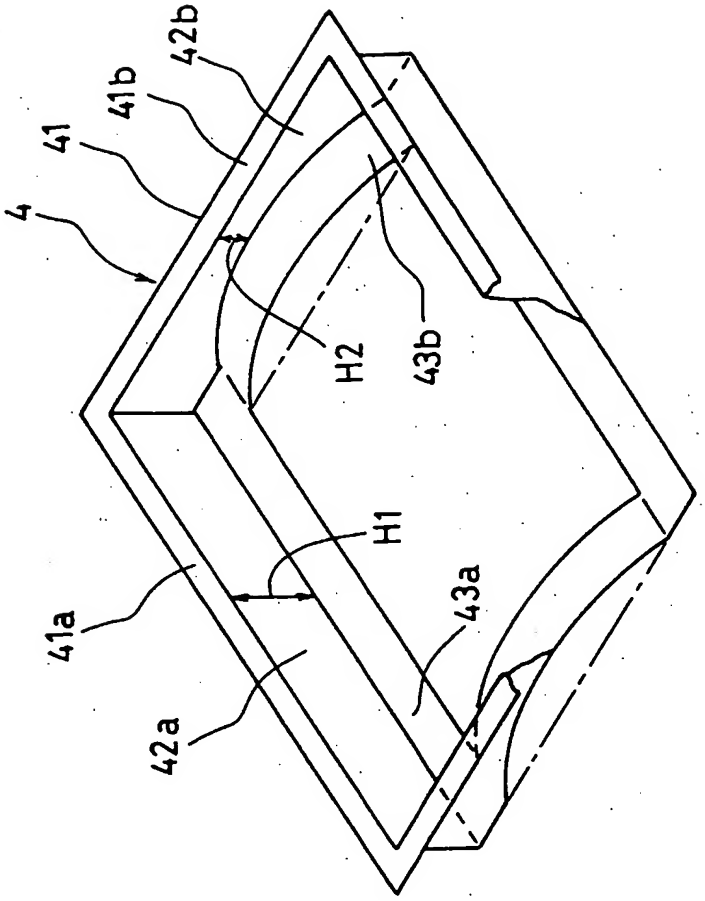

FIG.8

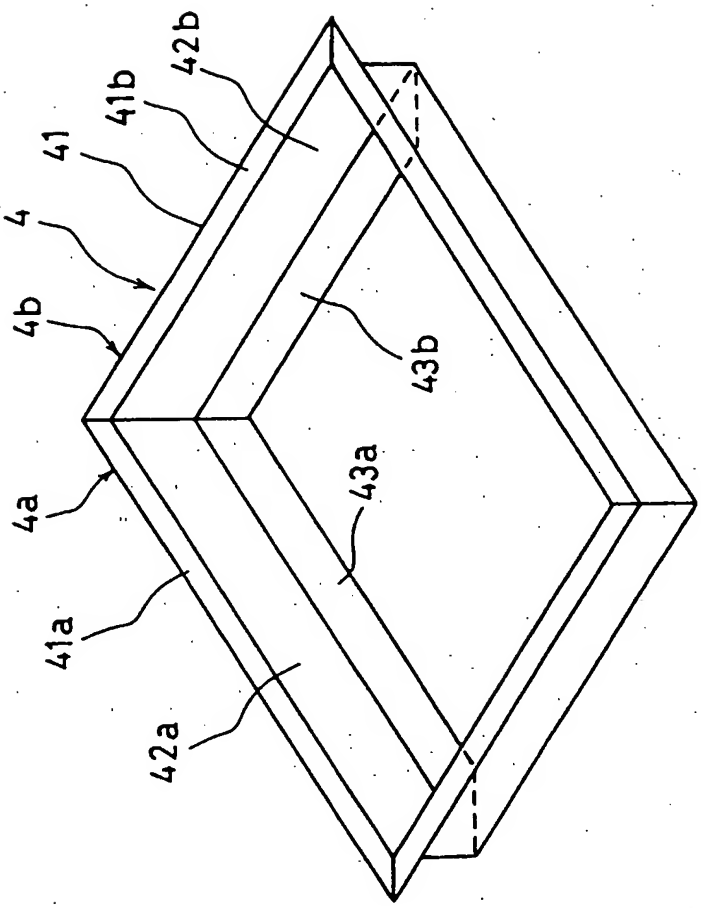

FIG.10

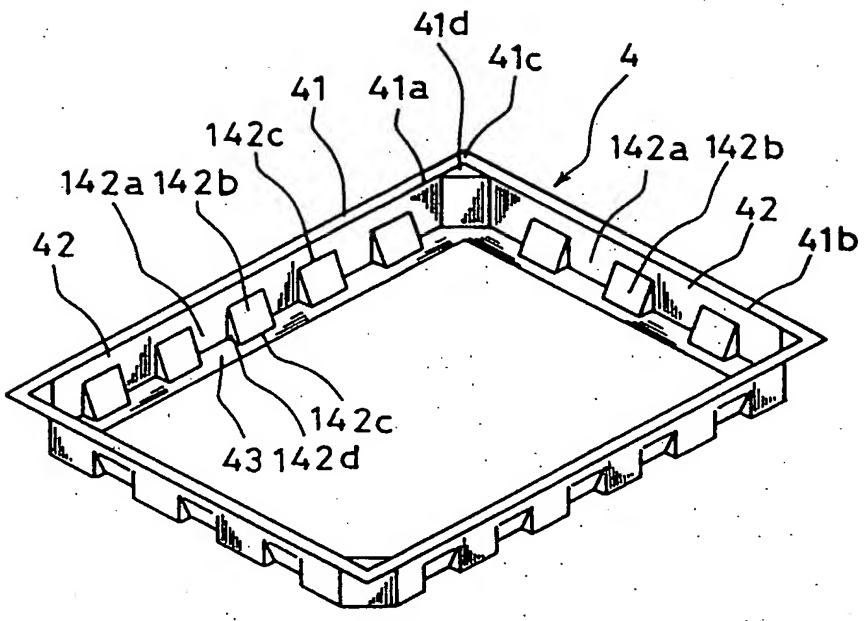

FIG. 12

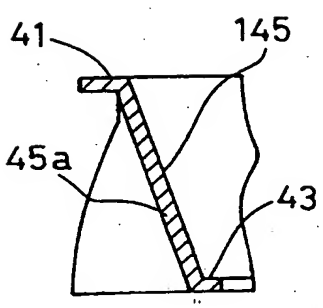

FIG.14(a)

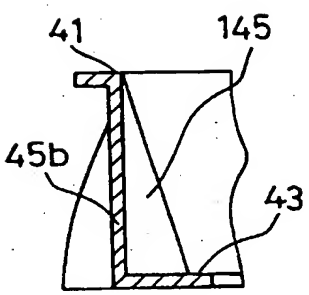

FIG.14(b)

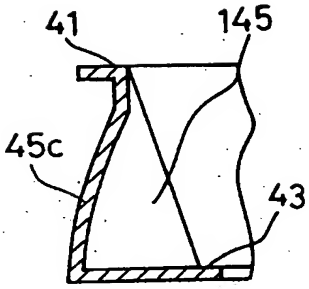

FIG.14(c)

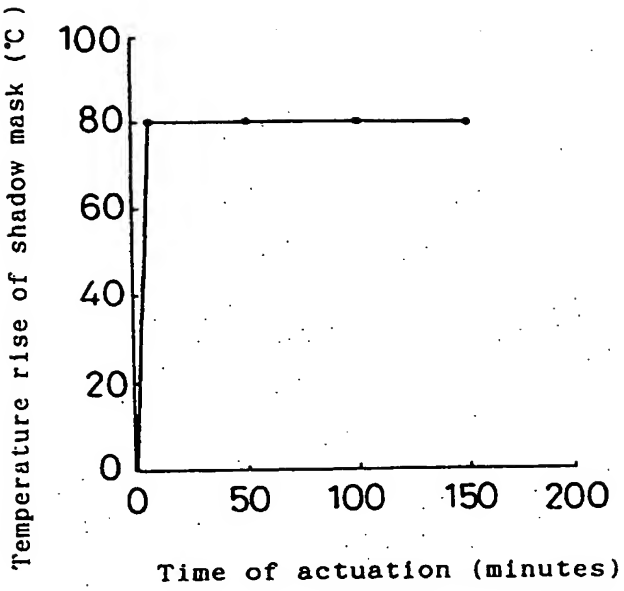
Temperature rise of shadow mask (℃)
100
80
60
40
20
0
0
50
100
150
200
Time of actuation (minutes)

FIG.16

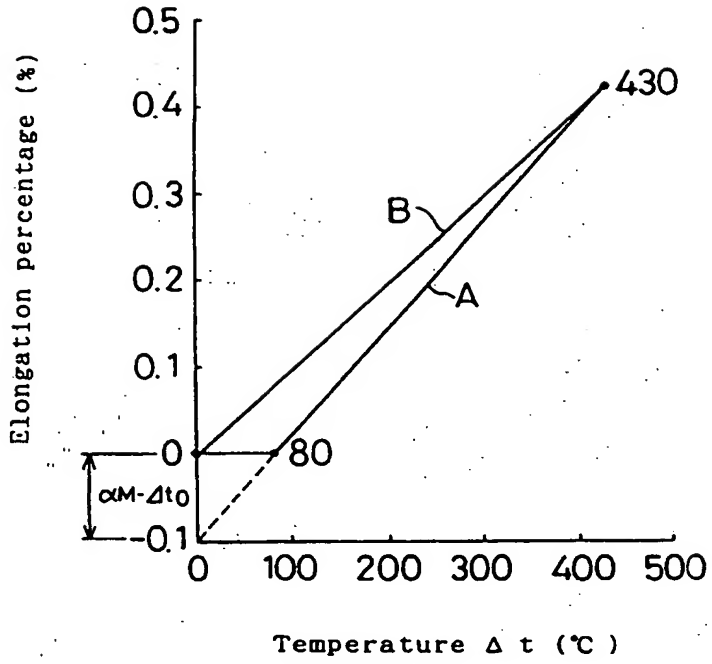
0.5
0.4
0.3
0.2
0.1
0
-0.1
Elongation percentage (%)
αM-Δt0
80
430
B
A
0
100
200
300
400
500
Temperature Δ t (℃)

FIG. 18

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(19) Europäisches Patentamt
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(54) Color cathode ray tube apparatus

(57) In a color cathode ray tube apparatus, a shadow mask is fixed on a frame with a predetermined tension for cancelling a thermal expansion of the shadow mask during normal operation of the color cathode ray tube apparatus. The mechanical strength of the longer sides on the frame is higher than that of the shorter sides of the frame by fixing reinforcing plates or ribs on the longer sides in order that the tension of the shadow mask not become uneven. Furthermore, the frame material can have a thermal expansion coefficient smaller than that of the material of the shadow mask.

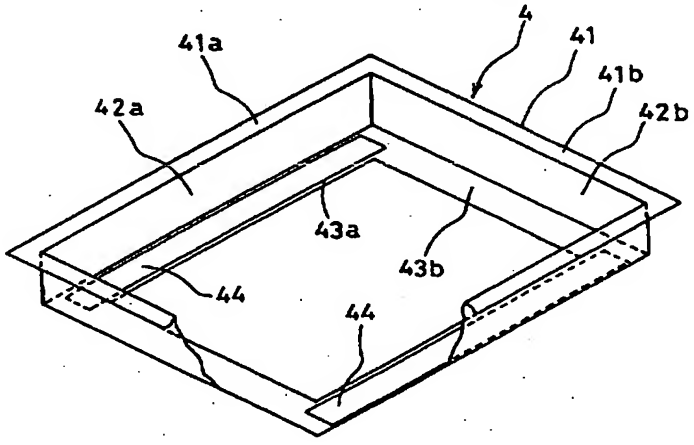

FIG. 2

EP 0 709 872 A3

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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 6896

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US-A-4 333 034 (OHGOSHI AKIO ET AL) 1 June 1982 * column 1, line 43 - column 2, line 21 * * column 2, line 30 - line 40 * * column 2, line 48 - line 60 * * column 7, line 14 - line 28 * * figure 7 *	1,2,6,13	H01J29/07
Y	GB-A-2 240 659 (SAMSUNG ELECTRONIC DEVICES) 7 August 1991 * figures 3,4 * * page 3, paragraph 4 * * page 4, last paragraph *	1,2,6,13	
A	EP-A-0 602 620 (SONY CORP) 22 June 1994 * figure 12 * * column 6, line 37 - line 47 *	19-23	
A		27	
D,A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 442 (E-1131), 11 November 1991 & JP-A-03 187132 (HITACHI LTD), 15 August 1991, * abstract *	4,8	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01J
A	GB-A-2 001 193 (INT STANDARD ELECTRIC CORP) 24 January 1979 * figure 1 * * page 1, line 57 - line 60 *	5,9	
A	PATENT ABSTRACTS OF JAPAN vol. 016, no. 318 (E-1232), 13 July 1992 & JP-A-04 092337 (SUMITOMO METAL MINING CO LTD), 25 March 1992, * abstract *	11	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 May 1996	Colvin, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 6896

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-5 218 267 (RAGLAND JR FRANK R) 8 June 1993 * column 1, line 57 - line 68 *	15	
D,A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 493 (E-0995), 26 October 1990 & JP-A-02 204943 (MITSUBISHI ELECTRIC CORP), 14 August 1990, * abstract *	18,28	
A	PATENT ABSTRACTS OF JAPAN vol. 004, no. 133 (E-026), 18 September 1980 & JP-A-55 086049 (TOSHIBA CORP), 28 June 1980, * abstract *	1	
A	US-A-4 069 567 (SCHWARTZ JAMES W) 24 January 1978 * abstract; claims * * column 4, line 34 - line 62 *	29	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	EP-A-0 228 110 (PHILIPS NV) 8 July 1987 * column 1, line 31 - line 40 *	29	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 May 1996	Colvin, G

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X : particularly relevant if taken alone
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,

namely:

- see 5 - sheet

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.

namely claims:

☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,

namely claims:

European Patent Office

EP 95 11 6896 -B-

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-28: Colour CRT with shadow mask frame with stronger long-side

2. Claims 29-30: Colour CRT with mask of thermal expansion coefficient greater than frame